

Remarks

Applicant respectfully requests that the Examiner withdraw the finality of this rejection.

All amendments made on the claims in response to the first Office Action were made on the basis of concrete objections raised by the Examiner. For instance, the Examiner objected to claim 1, paragraph 5, last two lines, that it was unclear how the acquisition of at least one pixel is functionally related to the rest of the invention. However, this was exactly the reason why Applicant cancelled the acquisition device for the sake of clarification, and in good faith, Applicant respectfully believes that is not needed for the invention. Yet, in the last Office Action, it was argued that this kind of amendment is not satisfactory and it turned out that this change was the basis for the finality of the current Office Action.

Claim Rejections Under 35 USC 112(2)

New head claim 43 is based on originally filed claim 1. However, further features have been adopted into the generic portion of claim 43, which are typically for an imaging and/or a raster-mode scanning apparatus. These parts can either be taken from Fig. 2 or are disclosed in originally filed claims 9 and 20 (now claims 51 and 62) and on page 4, first paragraph of the specification. Moreover, the whereby portion of the claim has been arranged into a more logical order, and includes features of independent claim 22 as originally filed.

Regarding the Examiner's "112" rejection in item 3 of the Office Action, it should be clarified that an object on the sample acceptance means (acceptor) is scanned by the scanning device (scanner) controlling the beam generated by the beam generating means (generator), whereby the scan results in an image acquired by the image acquisition device (acquirer), which should be understood to be both part of the claimed apparatus and the compensation device (compensator). Obviously, the image acquired by the image acquisition device (acquirer) can be

deteriorated by ambient influences. The problem of deteriorated images due to ambient influences is solved by the invention claimed in claim 43, such that a filter (4) is properly calibrated for compensation and that a signal representing the ambient influences, which can be a signal acquired by the image acquisition device (acquirer) too, is passed through the filter and drives an internal actuator and/or internal control elements of the apparatus to control the scanning device and/or the device for deflecting the sample acceptance means (acceptor) directly to compensate the ambient influences, which has an effect on the imaging and/or on the image display acquired via the image acquisition device (acquirer).

Claim Rejections Under 35 USC 102

Valid rejection under 35 USC 102 requires that each feature of a rejected claim be disclosed in a single reference. "For anticipation under 35 USC 102, the reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present." MPEP 706.02(a)

Neither Mizuno nor Masaki disclose each of the features of the rejected claims.

It should be noted that neither Mizuno nor Masaki applies the acquired ambient influences to a filter, which drives or control internal control elements to control a scanning device and/or a device for deflecting the sample acceptor for the purpose of compensation.

The fact that Mizuno's vibration control system can be applied to electron microscopes or the like does not anticipate all of the idea of the present invention to use internal means, i.e., internal control elements, to control the scanning device and/or a device for deflecting the sample acceptance means for the purpose of compensation. Note that Mizuno generally refers to actuators connected operatively to the body to be isolated (column 2, lines 23, 24). Thus, there is no statement whatsoever in Mizuno that would give a person of ordinary skill in the art a hint to

use internal control elements instead of conventional actuators. Of course, this is due to the fact that Mizuno deals with processing detected ambient influences, but does not think about how the resulting control signals could best be supplied to the isolation body for compensation purpose, as in the present invention.

The same is true for Masaki. Within the abstract of Masaki, it is stated that "The control signal calculated at high speed by the member 17 is passed through a D/A converter 18 and amplifier 19 to control an actuator member 3". If one takes this sentence in combination with the Figure from Masaki, it is clear that the actuator member 3 lies outside of the electron microscope to be isolated. Yet, as in the case of Mizuno, this is the common way that vibration isolation is performed. However, it is completely different than what the present invention does, which has been described herein previously.

Masaki, as well as Mizuno, try to compensate ambient influences that interfere with the body to be isolated in an indirect way by controlling actuators on the outside of the isolation body. In contrast, the present invention controls those elements of the apparatus to be isolated that have a direct influence on the imaging process of the apparatus. The direct compensation advantageously leads to a better compensation of ambient influences.

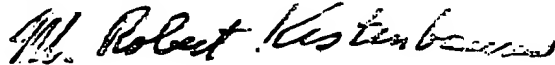
Claim Rejections Under 35 USC 103

Old claims 16, 20 and 24 (new claims 57, 61 and 66) are rejected as unpatentable over Masaki.

Rejection under 35 USC 103 requires that the cited art strongly suggests or motivates the ordinary person skilled in the art to apply the features of the rejected claims to achieve the claimed invention. Masaki does not strongly suggest or motivate the ordinary person skilled in the art to apply the features of the rejected claims to achieve the claimed invention.

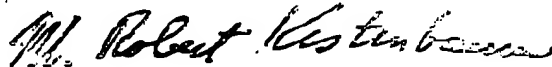
A two-month extension of time in which to response to the outstanding Office Action is hereby requested. PTO-2038 authorizing credit card payment for the amount of \$200 is enclosed for the prescribed Small Entity two-month extension fee. Any other fee due by virtue of this filing or this application should be charged to Deposit Account 11-0665 . Any refunds in connection with this filing should be credited to Deposit Account 11-0665. A duplicate of this page is enclosed for this purpose.

Respectfully submitted,



M. Robert Kestenbaum
Reg. No. 20,430
11011 Bermuda Dunes NE
Albuquerque, NM USA 87111
Telephone (505) 323-0771
Facsimile (505) 323-0865

I hereby certify this correspondence is being submitted to Commissioner for Patents, Washington, D.C. 20231 by facsimile transmission on September 14, 2002, fax number 703-308-7722.



M. Robert Kestenbaum

“Version with Markings to show Changes Made”

- 11 -

Figure 1b shows a block diagram of an apparatus 1 according to the invention, in which the calibration of the filter 5 and thus the calibration of the apparatus 1 are carried out by means of a second signal from an image processing device 2 (image processor) which is included in the image acquisition device 7 or is connected thereto.

Figure 2 corresponding to the block diagram of Figure 1b shows an apparatus of this type with the image processing device image processor being connected to the calibration input of the filter 5 in the case of a scanning electron microscope. The image acquisition device 7 (image acquirer) acquires at least one pixel of the object and supplies the image processing device 2. As in the case of the first embodiment, the signal of the sensor is fed forwards to the deflection coils 3a, 3b. A signal for driving the calibration input of the filter 5 is generated in the image processing device 2. The calibration of the filter 5 and thus of the apparatus 1 is described below with reference to two different embodiments.

According to a first embodiment, the microscope 1 is set up for operation in a calibration mode and an image mode, whereby, in the calibration mode, ambient influences that reduce the imaging quality can be detected by the imaging of a predetermined reference object and comparison of the image with the real structure of the reference object, and can be essentially eliminated by calibration of the microscope 1, and the imaging defects are greatly reduced or essentially compensated for, even in the event of a change in the ambient influences, by maintaining the calibration in the image mode. Depending on the operating mode, the input signal of the calibration input of the filter 5 either depends on the respective measured imaging defect (calibration mode) or is obtained by means of the data stored during the

“Version with Markings to show Changes Made”

- 12 -

calibration mode (image mode). It is possible to switch back and forth between the calibration and image modes.

The calibration mode is utilized in order to detect ambient influences, that is to say in this case the electromagnetic interference field which reduces the imaging quality, by the imaging of a predetermined section of a reference object and comparison of the image with the real structure of the reference object, and to calibrate the apparatus in such a way that systematic imaging defects caused by external ambient conditions and/or caused by instrumentation are essentially compensated for. According to the invention, this calibration of the microscope 1 is carried out by setting the transfer characteristic of the filter 5. Figure 3 illustrates how the scanning device (scanner) scans a selected section of a reference object in the calibration mode, in which case, in the digital image processing device 2, a stored signal assigned to the reference object is compared with the image signal of the reference object that is obtained from the image acquisition device 7 (image acquirer), and a signal assigned to the difference is formed and is output to the calibration input of the filter 5.

The calibration method in the calibration mode can be described by the following steps:

- determination of a first signal, which depends on the electromagnetic interference field at the location of the sensor, by a sensor 4;
- application of the first signal to the signal input of the filter 5;
- acquisition of a selected section of a predetermined reference object by means of an image acquisition device 7 (image acquirer) by scanning the reference object;
- comparison of the acquired image with the real structure of the reference object;

“Version with Markings to show Changes Made”

- 13 -

- determination of a defect signal assigned to the difference;
- application of the second signal, derived from the defect signal, to the regulating input of the filter 5 for defining the transfer characteristic of the said filter;
- application of the output signal of the filter 5 to the signal input of the regulating amplifier 6;
- application of the output signal of the regulating amplifier 6 to the electron beam detection coils 3a, 3b (Figure 2) for the purpose of correcting the reduced image quality;
- iterative calibration of the characteristic of the filter 5, in such a way that the reduction of the imaging quality is greatly reduced or essentially compensated for, by means of the following steps:
 - comparison of the corrected image with the real structure of the reference object
 - alteration of the transfer characteristic of the filter 5 in such a way that the corrected image approximates to the real structure of the reference object;
 - storage of data for generating the determined transfer function of the filter 5 for the image mode.

In one embodiment, these data for generating the determined transfer function of the filter 5 for the image mode are stored in a memory assigned to the image processing device 2. In a further embodiment, the filter 5 is set up for storing these data. While the imaging defect is being determined, the devices for compensating for the imaging defects (compensators) are switched off. The microscope 1 according to the invention is then calibrated by the method described

“Version with Markings to show Changes Made”

above, that is to say the feedforward for the measurement signal of the sensor is set as a measure of the interfering quantity.

Heiland
(H) 98HEL1149USP
09/423,155
Replacement Pages

“Version with Markings to show Changes Made”

- 14 -

The compensation quality is measured by repeated scanning of the reference object and comparison of the image with the real structure of the reference object. By determining the compensation quality in each case and correspondingly changing the transfer function of the filter, the feedforward is iteratively changed in such a way that the imaging defects of the scanning electron microscope are minimized.

The microscope 1 can be calibrated with regard to location- and/or time-variable imaging defects.

For this purpose, a reference object as shown in an exemplary fashion in Figure 3 is scanned on a predetermined path in the calibration mode. The imaged reference object comprises circular gold deposits which have been deposited on a substrate and are arranged in a predetermined manner. The scanning device of the microscope is driven externally, with the result that a selected section of the reference object is acquired. This path may, for example, be closed like that shown by the curve 9. Individual objects 8 are situated on this closed path, to which objects the image acquisition device 2 (image acquirer) responds and generates a signal not equal to zero. This is shown schematically and by way of example in Figure 4, which illustrates the signal profile 10 acquired at a given instant t_i during the traversal of the closed curve 9. Time-dependent interference can cause time-dependent imaging defects. For this reason, in the illustration of Figure 4, the closed curve has been traversed four times at intervals. The resulting four signal profiles 10 are thus also a measure of the temporal dependence of the interference. Furthermore, the traversed curve is altered by varying the radius R, whereby

“Version with Markings to show Changes Made”

location-dependent imaging defects can be detected. According to the invention, the time- and/or location-dependent imaging defects are determined by comparison of the

“Version with Markings to show Changes Made”

- 15 -

image in the image processing device (image processor) 2 with the predetermined reference object, which is known exactly. In the example represented in Figure 4, the time-dependent imaging defect is illustrated by the curve 11.

The image mode is the operating mode of the inventive scanning electron microscope 1 in which the actual sample is measured. The filter 5 transfer characteristic determined in the calibration mode is invariant during the subsequent image mode with regard to the characteristic defined in the calibration mode. As explained above, however, it can vary with respect to time and as a function of the scanning location.

Assuming an essentially constant correlation between the electromagnetic interference field and the imaging defect caused by this interfering quantity, the output signal of the filter 5, after passing through the regulating amplifier 6, is applied to the electron beam deflection unit 3, with the result that image defects are essentially compensated for even in the event of a change in the ambient influences, that is to say the strength of the electromagnetic interference field.

In an embodiment developed further, in addition to the electromagnetic interference fields, air vibrations and/or ground vibrations are also detected by corresponding sensors 4, the signals that are output pass through calibratable filters 5 which are assigned to the respective instances of interference and have adjustable transfer characteristics, and, after additional matching in the regulating amplifier 6, are applied to the deflection unit as a further control signal and/or to other actuators, with the result that the imaging defects caused by air vibrations and/or ground vibrations are also greatly reduced or essentially compensated for.